

Appln. No. 10/065,462
Docket No. 124611/GEM-0052

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (currently amended) A method for calculating duration of a representative cardiac cycle using ECG waveform data, the method comprising:

generating the ECG waveform data using an electrocardiogram device;
evaluating said ECG data to validate a signal from said electrocardiogram device;
detecting QRS complexes of ECG data using a detection function;
analyzing underlying cardiac rhythm based on said detected QRS complexes;
selecting an even number N of substantially normally shaped consecutive QRS

complexes;

computing an RR interval between said consecutive QRS complexes to yield N-1 intervals;

calculating duration of the representative cardiac cycle by averaging at least a plurality of said N-1 intervals;

wherein said calculating duration of the representative cardiac cycle by averaging includes averaging by one of: a mean method comprising discarding at least one of a longest and a shortest interval of said N-1 intervals, and computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan; and, a median method.[:,:]

~~wherein in response to said averaging being averaging by said mean method, said mean method comprises:~~

~~discarding at least one of a longest and a shortest interval of said N-1 intervals;~~

~~and~~

Appln. No. 10/065,462
Docket No. 124611/GEM-0052

~~computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan.~~

2. (original) The method of claim 1, wherein said selecting an even number N of substantially normally shaped consecutive QRS complexes includes $N \geq 8$.

3. (original) The method of claim 1, wherein said validating said signal from said electrocardiogram device includes evaluating for at least one of noise, baseline stability, artifacts, including combinations of at least one of the foregoing.

4. (original) The method of claim 1, wherein said analyzing underlying cardiac rhythm includes determination of a suitable heart rate.

5-6. (canceled)

7. (original) The method of claim 6, wherein said discarding includes discarding said N-1 intervals ≥ 1 second.

8. (original) The method of claim 5, wherein said median method comprises:
arranging said N-1 intervals in ascending order; and
selecting a middle interval of said N-1 intervals in ascending order, said middle interval indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan.

9. (original) The method of claim 1, wherein said selecting an even number N of substantially normally shaped consecutive QRS complexes includes selecting N+L consecutive QRS complexes if abnormally shaped QRS complexes are present, where $L \geq 2$ and N+L is an even number.

Appl. No. 10/065,462
Docket No. 124611/GEM-0052

10. (currently amended) A medium encoded with a machine-readable computer program code for associating ECG waveform data with medical imaging data using a data synchronization scheme, said medium including instructions for causing a controller to implement a method comprising:

- generating the ECG waveform data using an electrocardiogram device;
- evaluating said ECG data to validate a signal from said electrocardiogram device;
- detecting QRS complexes of ECG data using a detection function;
- analyzing underlying cardiac rhythm based on said detected QRS complexes;
- selecting an even number N of substantially normally shaped consecutive QRS

complexes;

- computing an RR interval between said consecutive QRS complexes to yield N-1 intervals;

- calculating duration of the representative cardiac cycle by averaging at least a plurality of said N-1 intervals;

- wherein said calculating duration of the representative cardiac cycle by averaging includes averaging by one of: a mean method comprising discarding at least one of a longest and a shortest interval of said N-1 intervals, and computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan; and, a median method.[:];]

- ~~wherein in response to said average being averaging by said mean method, said mean method comprises:~~

- ~~discarding at least one of a longest and a shortest interval of said N-1 intervals; and computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan.~~

11. (original) The medium of claim 10, wherein said selecting an even number N of substantially normally shaped consecutive QRS complexes includes $N \geq 8$.

Appl. No. 10/065,462
Docket No. 124611/GEM-0052

12. (original) The medium of claim 11, wherein said validating said signal from said electrocardiogram device includes evaluating for at least one of noise, baseline stability, artifacts, including combinations of at least one of the foregoing.

13. (original) The medium of claim 11, wherein said analyzing underlying cardiac rhythm includes determination of a suitable heart rate.

14-15. (canceled)

16. (original) The medium of claim 15, wherein said discarding includes discarding said N-1 intervals ≥ 1 second.

17. (original) The medium of claim 14, wherein said median method comprises:

arranging said N-1 intervals in ascending order; and
selecting a middle interval of said N-1 intervals in ascending order, said middle interval indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan.

18. (original) The medium of claim 10, wherein said selecting an even number N of substantially normally shaped consecutive QRS complexes includes selecting N+L consecutive QRS complexes if abnormally shaped QRS complexes are present, where $L \geq 2$ and N+L is an even number.

19. (currently amended) A method for associating ECG waveform data with image data generated by an imaging system using a data synchronization scheme comprising:

obtaining the imaging system, an electrocardiogram device and an object to be examined;

Appl. No. 10/065,462
Docket No. 124611/GEM-0052

associating said object with the imaging system and said electrocardiogram device; and

processing the image data and the ECG waveform data using the data synchronization scheme wherein the data synchronization scheme,

generates the ECG waveform data using an electrocardiogram device;

evaluates said ECG data to validate a signal from said electrocardiogram device;

detects QRS complexes of ECG data using a detection function;

analyzes underlying cardiac rhythm based on said detected QRS complexes;

selects an even number N of substantially normally shaped consecutive QRS complexes;

computes an RR interval between said consecutive QRS complexes to yield N-1 intervals; and

calculates duration of the representative cardiac cycle by averaging at least a plurality of said N-1 intervals;

wherein said calculates duration of the representative cardiac cycle by averaging includes averaging by one of: a mean method comprising discarding at least one of a longest and a shortest interval of said N-1 intervals, and computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan; and, a median method.[:,]

~~wherein in response to said averaging being averaging by said mean method, said mean method comprises:~~

~~discarding at least one of a longest and a shortest interval of said N-1 intervals;~~

~~and~~

~~computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan.~~

20. (currently amended) A system for associating ECG waveform data with image data using a data synchronization scheme comprising:

an imaging system;

Appln. No. 10/065,462
Docket No. 124611/GEM-0052

an object disposed so as to be communicated with said imaging system, wherein said imaging system generates image data responsive to said object; and

a processing device having the data synchronization scheme, wherein the data synchronization scheme,

generates the ECG waveform data using an electrocardiogram device;

evaluates said ECG data to validate a signal from said electrocardiogram device;

detects QRS complexes of ECG data using a detection function;

analyzes underlying cardiac rhythm based on said detected QRS complexes;

selects an even number N of substantially normally shaped consecutive QRS complexes;

computes an RR interval between said consecutive QRS complexes to yield N-1 intervals; and

calculates duration of the representative cardiac cycle by averaging at least a plurality of said N-1 intervals;

wherein said calculates duration of the representative cardiac cycle by averaging includes averaging by one of: a mean method comprising discarding at least one of a longest and a shortest interval of said N-1 intervals, and computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan; and, a median method. [[;]]

~~wherein in response to said averaging being averaging by said mean method, said mean method comprises:~~

~~discarding at least one of a longest and a shortest interval of said N-1 intervals;~~

~~and~~

~~computing a mean of a remaining N-1 intervals indicative of the representative cardiac cycle so as to associate with a computed tomography imaging system scan.~~

21. (original) The system of claim 20, wherein said object is a patient.

Appln. No. 10/065,462
Docket No. 124611/GEM-0052

22. (original) The system of claim 21, wherein said imaging system is a computed tomography imaging system.

23-36. (canceled)

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.